International Research Journal of Education and Technology
Peer Reviewed Journal
ISSN 2581-7795

Review On Power Quality Improvements in Grid-Connected PV System Using Hybrid Technology

Bipin Kumar[1] ,Prakash Narayan Tiwari[2]

M.Tech Scholar Department Of Electrical and Electronics Engineering, Rabindranath Tagore University,India,Bhopal,M.P

Assistant Professor Department Of Electrical and Electronics Engineering, Rabindranath Tagore University,India,Bhopal,M.P

ABSTRACT- In recent trends, photo-voltaic (PV) is mostly build upon competitive technological development of power quality (PQ) issues. In this article, a hybrid control strategy is implemented with multi-level inverter (MLI) to improve PQ features. As a result, the combination of these controllers with suitable level of MLI could improve the PQ features in a significant way Power quality is highlighted as an important parameter in modern power systems. Moreover, grid-connected photovoltaic power plants are increasing significantly in size and capacity. Elsewhere, due to the progressive integration of nonlinear loads in the grid, the principal role of a Solar Energy Conversion System (SECS) is not only to capture the maximum power from solar but, also to ensure some ancillary services and improve the quality of power. This paper presents a novel strategy dedicated to improve the management of active power generation, reactive power compensation and power quality of SECS, while guaranteeing the possibility of exploiting the full capacity of the Power Conditioning System (PCS) and the Photovoltaic System (PVS) using filters. The proposed control algorithm is applied to a large scale PVS connected to the grid.

Keywords. Multi-level inverter (MLI), Photo-voltaic (PV) energy, Power quality (PQ), Hybrid control, Electrical microgrids (MGs).

I. INTRODUCTION

One of the most useful types of energy is electrical, which completely depends on the availability of power. As a result, the power quality is a critical aspect that is crucial for the efficient handling of user-side equipment. Power ranges for voltage and frequency play a role. The quality of power suffers if the variety deviates from the usual range High Voltage - Direct Current transmission systems were first used in 1954 with the first commercial transmission link between Gotland Island and the Swedish mainland. This took place about half a century after the so called "war of currents," where Edison strongly advocated the use DC current whereas Westinghouse, Tesla and Steinmetz advocated the use of AC current instead. DC technology almost disappeared in the power transmission sector because of the usefulness of rotating magnetic fields produced by AC currents coupled with the low cost of transmission resulting from increases in AC voltages thanks to the development of transformers; that is until the 1950s when the mercury-arc valve had a high enough capacity to convert high AC voltage to high DC voltage and vice-versa. Semi conductor devices have undergone a significant advancement due to technological advancement. Semiconductor devices are essential in the energy sector because they make system control easier. The semi conductor devices, however, pull nonlinear current from the source because they themselves nonlinear. Reactive power and Harmonics are produced when nonlinear loads are used. Harmonics are seen as a serious issue with power quality .Harmonics must be removed in order to keep power quality and keep Total harmonic distortion below 5% according to IEEE 519 harmonics standard.

II. APPLICATIONS OF MULTILEVEL CONVERTERS

Power electronics are fundamental components in consumer electronics and clean energy technologies. For Modern high-power applications, multilevel converters are picking up a considerable measure of consideration, and are getting to be noticeably one of the top clean power and energy change decisions for new topologies and control in industry and the scholarly world. Presently, multilevel converters are marketed in standard and altered products that power an extensive variety of uses, for example, compressors, extruders, pumps, fans, granulating plants, moving factories, transports, crushers, impact heater blowers, gas turbine starters, blenders, mine derricks, reactive power compensation, marine

impetus, high-voltage coordinate current (HVDC) transmission, hydro pumped capacity, wind energy transformation, and railroad footing, to give some examples. Several well-known companies offer multilevel converters commercially for these applications in the field.

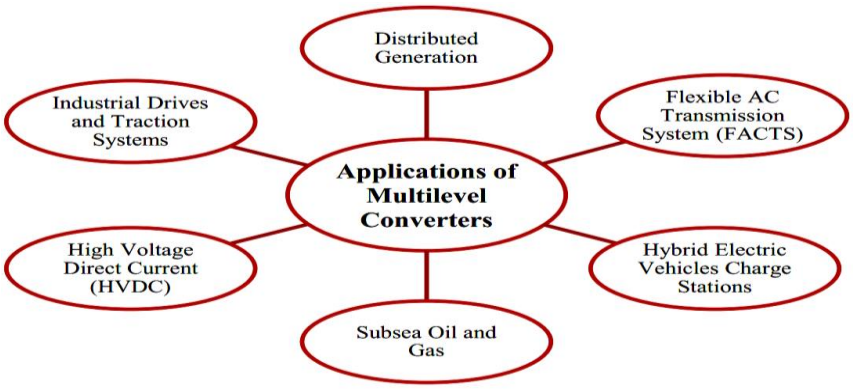

Figure: Applications of Multilevel Converters.

III. OBJECTIVE

Harmonics lead to the source voltage being distorted, additional loss from undesired current flowing in the source, and the malfunction of mains, relays, CB and other control devices. Therefore, reducing the harmonics is necessary. There are numerous ways to lessen the impact of harmonics. One of these techniques involves the use of SAPF, which generates harmonic current in the system with opposite polarity and identical magnitude. This cancels the harmonic current. It responds quickly and operates with versatility techniques involves the use of SAPF, which generates harmonic current in the system with opposite polarity and identical magnitude. This cancels the harmonic current. It responds quickly and operates with versatility

IV. POWER QUALITY

The increased usage of power electronic devices in power system including renewable power generations led to a number of power quality (PQ) problems for the operation of machines, transformers, capacitors in power systems. PQ covers all parts of power framework building from transmission and circulation level investigations to end-client issues. In this way, electric power quality has become a serious concern for both utilities and end users. The PQ, at conveyance level, comprehensively alludes to keeping up a close sinusoidal power circulation transport voltage at an evaluated extent and frequency. In addition, the energy supplied to a customer must be uninterrupted. Therefore, the term PQ includes two aspects, namely voltage quality and supply reliability The voltage quality side contains different unsettling influences, for example, fast changes, harmonics, inter harmonics, glint, irregularity and drifters, while the dependability side includes wonders with a more drawn out length, for example, intrusions, voltage plunges and hangs, over and under voltages and frequency deviations. The above issues are significant in depicting the actual phenomena that may cause PQ problem

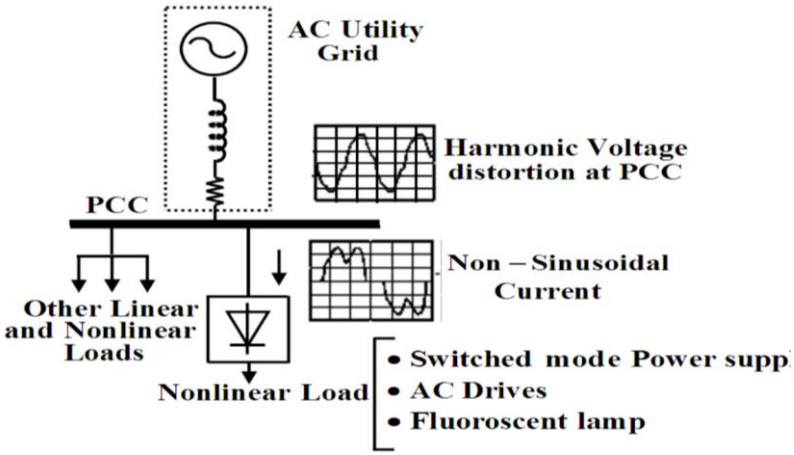

Figure: Harmonic Distortions

V. The Shunt Active Power Filter (SAPF)

To enhance the power quality in the grid-integrated solar system, the Shunt Active Power Filter (SAPF) with fuzzy logic controller and DC to DC converter with PID controller must be designed. A shunt active power filter serves as a harmonic correction device (SAPF). The SAPF is a voltage source inverter for loads. Under various load scenarios, balanced current can be maintained via shunt active power filters. The conversion of DC to AC electricity is done by power switching devices. A grid-connected solar PV system is an electrical converter that transforms direct current (DC) electricity from a PV module into alternating current (AC). The fuzzy control-based, pulse width modulation approach is employed. A combination of power electronic and traditional power system components served as the foundation for the configuration and design of these devices. It is necessary to develop and simulate the proper fuzzy control technique in order to improve the quality of the power produced by the grid-integrated solar system

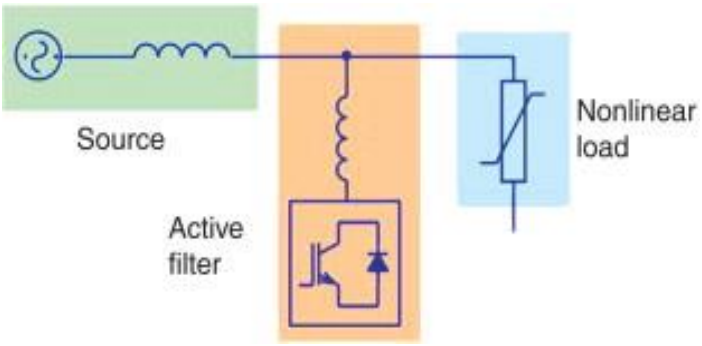

Figure: The Shunt Active Power Filter (SAPF)

VI. EXPECTED OUTCOMES

New advancements in solar PV system research, including solar PV array and MPPT systems and converters. The use of a multi-level inverter is applications that demand an output of a clean AC sine waveform with decreased voltage stress and harmonic distortion. A Pulse width modulated inverter is used to reduce Total harmonic distortion in a 3ø system with a nonlinear load after it has been analyzed and modeled. mostly solar panels dependent on temperature and generate very low output voltage irradiance, therefore it's required to use a boost converter to improve the employing a voltage and to keep the output voltage constant, when compared to traditional PID controllers, the fuzzy PID controller improved the performance of the boost converter by supplying a more steady 24 V DC. The PID parameters can be accurately generated in the fuzzy mamdani design. A lower overshoot is produced with a shorter rising time by the fuzzy PID controller. For standalone PV generation systems, various filters are analyzed and designed. Topologies for LC, LCL, and LLCC filters are taken into account. The power quality of a stand-alone PV production system can be improved more effectively with LLCC filter structure.

VII. CONCLUSION This suggested system's harmonics were successfully removed using SAPF. Comparing FUZZY controlled SAPF with other traditional methods reveals that the THD is limited. The results obtained show that the suggested model executes the inverter and grid THD is reduced. The final result of the grid-connected PV system simulation model demonstrates a decrease in harmonics in the inverter when interacting with the grid.

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